Simulating Land Use Dynamics in SE Asia: A Cellular Automaton Approach

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- http://www.cpc.unc.edu/projects/nangrong/

Introduction: Thailand

- **Question:** What are the LCLUC patterns and trajectories at the pixel and other levels, and how are they affected by cyclic and random endogenous and exogenous factors operating across space and time scales responsive to selected scenarios of human-environment interactions?

- **Goal:** Simulations of LCLUC patterns for Nang Rong, Thailand relative to a) history and spatial pattern of village settlement; b) road development, expansion of available vehicles, and changing geographic accessibility; c) migration and household formation; d) land titling and linkages to investment in various land uses; e) climate and monsoon history; f) global economic factors, including world cassava prices and the 1997 economic crisis; g) electrification, and the accompanying rise in TV viewer-ship and consumerism.

- **Approach:** Spatially-explicit, cellular automata (CA) simulations are developed for the above scenarios to examine LCLUC patterns for historical, contemporary, and future periods for local and regional places.

Results: Thailand

- **Most Significant:** a) combining stochastic and deterministic processes in a single CA model to integrate human & natural systems, b) examine scenarios based on empirical relationships in seven areas to examine the spatial distribution as well as the composition of LCLUC, LCLUC trajectories at the pixel and other levels, and temporal and spatial scale dependencies.

- **Future Steps:** a) simulate LCLUC patterns elsewhere in SE Asia by perturbing our CA-based Nang Rong simulations for conditions that represent alternate development processes, b) develop "pixel histories" through an assembled panel data set of LCLUC patterns at the pixel level to examine the stability and dynamics of landscape conditions and to model the associated population-environment processes.

Conclusions: Thailand

- **Most Important**:

Space and time dependence of human-environment interactions and LCLUC patterns is fundamental; spatial simulations of LCLUC patterns using CA are affected by growth or transition rules and neighborhood associations informed through a deep satellite time-series, longitudinal survey data, and linked GIS coverages for model calibration and validation.

- **Selected Publications**:
- Tang, W., Malanson ,G.P., Entwisle, B., Walsh, S.J., Rindfuss, R.R., Prasartkul, P., 2003. Village location in Thailand: visualization of agent-based modeling with follow-on interviews. *Environment & Planning B*, in review.

- Rindfuss, R.R., Prasartkul, P., Walsh, S.J., Entwisle, B., Sawangdee, Y., Vogler, J.B. 2002. Household-parcel linkages in Nang Rong, Thailand: challenges of large samples. In: *People and the Environment: Approaches for Linking Household and Community Surveys to Remote Sensing and GIS*, (J. Fox, R.R. Rindfuss, S.J. Walsh, V. Mishra, editors), Kluwer Academic Publishers: Boston, 131-172.

- Rindfuss, R.R., B. Entwisle, S.J. Walsh, P. Prasakurt, Y. Sawangdee, T.W. Crawford, J. Reade, 2002. Continuous and discrete: where they have met in Nang Rong, Thailand. *Remote Sensing and GIS Applications for Linking People, Place, and Policy* (S.J. Walsh and K.A. Crews-Meyer, editors), Boston, MA: Kluwer Academic Publishers, 7-37.